PUBLIC HEALTH.

E. A. PARKES

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BY THE LATE

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TO WHICH IS ADDED A SHORT PAPER CONTAINING

HINTS TO THE MEDICAL OFFICERS OF THE ARCTIC EXPEDITION UNDER CAPTAIN NARES, AS TO EXPERIMENTS ON DIET AND BODY-TEMPERATURE IN THE POLAR REGIONS.

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PREFACE.

AT intervals during his last fatal illness Dr. Parkes was engaged, with his usual industry, in such literary work as he could undertake; and this short treatise on Public Health, which then engaged his attention, was found completed after his death.

It is intended simply to give a general outline of the questions embraced by the Legislative Acts of this country regarding Public Health; and to show the points which are now especially engaging attention, and which have to be considered both in legislation and in the daily practical performance of the duties of Medical Officers of Health.

At the close of a life so active and so useful as that of Dr. Parkes was known to be, this little book —his last work—cannot fail to be not only of great interest, but of great value;—of great interest, as the last parting words of one whose life was devoted to the public good;—of great value, as giving form and expression to the results of a prolonged, varied, and matured experience regarding the numerous

and very difficult subjects which demand grave consideration in the details necessary for preserving and improving Public Health.

On these grounds it is believed that the publication of this short but comprehensive treatise will be acceptable to a large circle of readers; for it appeals alike to Political Economists, to the Members of our Legislative Assemblies, to the Medical Profession generally and to Officers of Health in particular, to Municipal Corporations, to large Employers of Labour, and to the Public generally, who ought to be especially interested in the maintenance of Public Health.

I have been requested by Dr. Parkes's brother and by the publishers to look over the MS., and to revise the proof-sheets, and have to state that the work appears exactly as Dr. Parkes left it, that nothing has been added beyond filling in a verbal blank, or an omitted date or reference, and writing a table of contents and two footnotes, the work having been left by Dr. Parkes perfectly complete in itself.

A short paper is added as an Appendix, embracing suggestions relative to experiments on diet and body-temperature in Arctic travelling.

W. A.

July, 1876.

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PUBLIC HEALTH.

In all civilized countries laws are made with the intention of removing conditions which injure the health of the people. In the United Kingdom these laws are now very numerous, and almost every year new statutes regulating public health are enacted. The general fault of the Acts is their tentative and permissive character; powers are not infrequently given which there is no obligation to use, and which are therefore not used, and the wording of the Acts sometimes permits evasion. The ambiguous expression of the Acts arises from the difficulty of determining the proper limits of the action of the State—*i.e.*, especially as to the questions when and in what way the State is justified in assuming the right to interfere with private property, with private enterprise, and with individual responsibilities.

These are difficult questions, for though it is undoubted that the community as a body has a just power of setting aside the rights of individuals when necessary for the benefit of all its members,

yet it is obvious that such power must be exercised with great discretion, lest the right to property and the incentive to labour and to self-improvement should be endangered. Still it cannot be doubted that our laws have been influenced by an unnecessary timidity, and have been too much hampered by opposing opinions. There are some writers who question whether the State has any right to interfere with individual action in this or in any other matter; but to this it seems answer enough to say that a community is after all nothing but a collection of individuals whose united action is merely the individual action combined; that such union is a necessity for the security of life and property, and that there can be no reason why this combined action should not also regulate the important conditions of public health, as well as the relations of property and the conduct of individuals. Practically, also, there are conditions affecting the health of its members with which the community at large alone can deal, and with which therefore it ought to deal. It can also be shown that this common action has already been productive of the greatest good in several cases, and is absolutely necessary in order to counteract the ignorance, carelessness, selfishness, and avarice of men.

Although there are many old statutes and also provisions in the common law of England affect-

ing the public health, the sanitary legislation of England may be said to date from the passing of the Public Health Act of 1848 (11 & 12 Vict. c. 63). That Act was followed by the Nuisances Removal Act of 1855 (18 & 19 Vict. c. 121), the Local Government Act of 1858 (21 & 22 Vict. c. 98; amended by 24 & 25 Vict. c. 61), the Sanitary Act of 1866 (29 & 30 Vict. c. 90), and the Public Health Act of 1872 (35 & 36 Vict. c. 79), besides numerous less important Acts Also local Acts for towns and byelaws made under the authority of the Public Health Acts give additional local powers. It is probable that eventually a great Consolidation Sanitary Act will bring all the enactments into one statute. In Scotland and Ireland there are other Acts carrying the same powers.

In the following pages a general outline is given of this subject. It is of course impossible to fill up the details, which require special works for almost every heading; but the outline will show the points which are now especially engaging attention, and which have to be considered both in legislation and in the practical performance of the duties of medical officers of health.

CONDITION OF OPEN LANDS, FORESTS, RIVERS.

The drainage of land, so as to carry off water readily, and thus to make both ground and air drier, has a great effect on public health. Ague, so common formerly in England, has greatly lessened, and dysentery, which so often went with it, has almost disappeared in consequence of drainage. The movements of the ground water, which by its rises and falls influence the moisture and the amount of air in the soil, and through these conditions alter the amount and rapidity of decomposition, have been supposed also to influence health, and to be especially connected with the development of typhoid fever and of cholera. A moist ground is also believed on tolerably strong evidence to be favourable to the production of destructive lung diseases, and there is no doubt that rheumatism and catarrhal affections are more common on damp soils. There is no doubt also, that lowering the level of the ground water when it is near the surface is often followed by the best results on the general health of the people ; and in hot countries malarious diseases have been greatly diminished, even when the lowering of the ground water did not exceed a few inches.

Drainage operations as influencing public health

might therefore be undertaken by the State, but practically they have been carried on in this country by private enterprise, aided of late years by State loans on moderate terms of interest and repayment. In India this question of land drainage is of pressing importance in several waterlogged, wet, and malarious districts, and it is one which must eventually be met by the State, though its magnitude and cost will probably cause the question to be deferred as long as possible.

The regulation of irrigation operations may also become an important matter of State control in this country if sewage irrigation farms increase in number. These farms should not be situated near to houses (not within 500 yards, if possible); and the land should be properly prepared and drained, so that there is no stagnancy of the water. If properly arranged, it seems clear that sewage irrigation is not hurtful to the public health. Rice field irrigation is more difficult to manage, as the water must rest longer on the ground, and underground drainage is less rapid. Rice fields then should be situated at a greater distance from houses.

Up to the present time no law in England deals with the subject of land drainage in reference especially to public health, for the Land Drainage Act of 1861 (24 & 25 Vict. c. 133) refers only to agricultural purposes and operations.

The regulation of forests ought to be considered a State matter, as the climate of a country, and therefore public health, are greatly influenced by them. The removal of forests produces various effects ; which are useful or not, according to circumstances. Greater movement of air over the earth is permitted which may be advantageous, or the reverse if the air be too cold ; or malarious air may no longer be kept away as is supposed to be the case with the Roman Campagna. The soil is rendered hotter in all temperate and hot countries, colder in northern lands. The air is drier everywhere because the rainfall is lessened ; the ground too is drier and the evaporation from leaves is lessened. The ground is drier because there is not only less rain but freer evaporation, and the roots of the trees no longer obstruct the movement of the ground water which flows off more rapidly. Hence in hilly countries where the trees have been too much cleared off there occurs aridity of soil as a rule, and greater rapidity in the amount of water passing into rivers during rains leading to floods. Owing to the peculiar geographical and social condition of this country, the regulation of forests is not a matter of great importance ; it is otherwise in Germany and France, where laws exist which restrain private action ; and in Italy, Greece, and Turkey the condition of the forests requires grave consideration as

regards public health as well as climate and rainfall. In India this is also the case, and it is to be hoped that the officers of the Forest Department may be instructed not to overlook this important matter.

The regulations of rivers, such as the embankments, narrowings, deepenings, and removal of obstructions, have generally been exercised in consequence of impediments to navigation, or in prevention of inundations; but they are equally important as influencing the outflow of the land water from the drainage areas, and in that way influencing the dryness of the soil. As obstructing or facilitating drainage of this kind the condition of all watercourses is a matter of importance, and seems obviously a case for State control. It is not, however, usually included in the subjects of public health, and when any large watercourse is out of order, and inundations from the river or from the sea are dreaded, the Crown usually appoints, on the application of the proprietors of land, a commission of sewers under the Land Drainage Act of 1861 to consider what should be done.

In another way the regulation of rivers is of importance. They supply the drinking water of the community to a large extent, and freedom from contamination is therefore necessary. At present this is one of the most difficult questions of public health, and for some years a Royal Commission has been inquiring into the causes of

the pollution of rivers and the remedies which ought to be applied. The chief causes of river contamination are the dirty water and sewage coming from towns, and the refuse of trade operations. The former can be met by precipitation with chemical substances or filtration through land, though the immense quantity of water to be purified and the price or position of land cause difficulty in some cases. The admixture of trade refuse water presents, however, the greatest difficulty ; to prohibit the flow into streams would sometimes be to prohibit the trade works, and it remains to be seen whether the Rivers Pollution Commissioners will be able to suggest efficient means of purification without too much interference with trade action. At present there is no settled standard of purity for either town or trade water before its discharge into streams, and it is probable that the standard must vary and must depend on the composition of the water as originally supplied, and the relation between its amount and the body of water into which it is discharged. Under the 11 & 12 Vict. c. 63, 28 & 29 Vict. c. 75, and 29 & 30 Vict. c. 90, a sewer authority can protect any watercourse within its jurisdiction from pollution with sewage, gas, or with other sources of contamination (except trade refuse). On the other hand, a sewer authority can be indicted by landowners or others for creating a nuisance, or

for injuring the quality of the water. In certain cases, as of the rivers Thames and Lea, special Acts restrain the pouring of sewage into them.

It may be said on the whole that the law is at present undecided with respect to pollution of rivers, but that the general tendency of legislation is gradually to make the rules for preserving the purity of river water more and more stringent.

CONDITIONS OF HABITATIONS.

In the case of a town of any size, the community is represented by a municipal body, or by a board of health, or by local commissioners acting under the Sanitary Acts. In the case of villages, the poor-law union guardians are the sanitary authorities unless the district is attached to a town. In the language of the Public Health Act of 1872, the former are the urban and the latter the rural sanitary authorities.

Under the head of habitations and groups of houses, almost all the subjects comprised under the term "Public Health" may be conveniently placed, and may be best considered under the heads of :—

1. *Collections of houses* forming cities and towns, *i.e.*, with populations over 2000 persons.
2. *Villages*, *i.e.*, with populations of or under 2000 persons.
3. *Houses*, detached or semi-detached.

I. Cities and Towns.

The health of the inhabitants of English towns, as judged by the annual rate of mortality, is not so good as that of the people of rural districts. The mean annual mortality differs in different towns from 20 or 21 to 35 and 36 per 1000 of population, while during certain periods it may be much more. In healthy rural districts the mortality is from 17 to 23 or 24 per 1000. The causes of the difference are various ; in towns there is greater crowding, more poverty, a higher degree of impurity in the air of the houses, a greater prevalence of infectious diseases, and greater exposure to disease from unhealthy trades. The urban inhabitants are also, on the whole, more intemperate and less vigorous in frame, and have less active exercise in the open air than the rural population. It is, however, especially the mortality of children under five years old in towns which swells the death rate, owing to the bad food and the exposure to impure air and cold of the children of the poor. In all cities there are districts inhabited by wealthy people where the mortality is as low as in the most healthy country places. It ought to be possible, therefore, to raise the health of the inhabitants generally to the standard of these favoured districts, for poverty can be placed in as good hygienic conditions as wealth, though it may

demand rather more thought and contrivance to accomplish this.

HYGIENIC CONDITIONS OF CITIES AND TOWNS.

These are conditions referable to—

1. The site and soil.
2. The arrangement and building of houses.
3. The water supply.
4. The disposal of dirty house-water or slops, and of dry refuse.
5. The removal of excreta.
6. The conservancy of the surface area.
7. The supply of food, including the regulation of slaughterhouses, cowhouses, and bakehouses.
8. The regulation of trades.
9. The arrest of contagious infectious diseases.
10. The disposal of the dead.

1. *The Site and Soil.*—The sites of the old cities of Europe were fixed by reasons of war or commerce, or of vicinity to water supply ; when modern cities arise, it is in consequence of new industries being developed (in this country coal and iron or cotton or woollen works), and the site is determined by convenience of trade. It is much to be desired that the Legislature should enforce rules in the case of such new towns or in enlargement of old towns, as far as regards width and direction of streets and juxtaposition of houses, so as to

insure good ventilation of the town and correct and easy lines for sewers and water pipes. These new towns and villages in England spring up without regulation ; and when they attain a certain size, and some sort of municipal government is formed, it is often too late to attend to the arrangement and construction of houses and to the proper preparation of the ground. In the case of old towns, it has often been necessary to obtain Local Improvements or Health Acts, by which the errors of bygone times are being slowly and laboriously removed.

In respect of the site, it is necessary to dry the ground if it is at all damp, and to keep it from being contaminated by refuse and permeation of coal gas. It is one of the advantages of sewering a town that the ground is thereby drained, and many sewers are now laid so as to facilitate the movement of the ground water, as well as to serve as channels for house water. For this reason alone every town ought to have either a system of sewers, or deep drainage of some kind. There should be no cess pits, or middens,* or manure heaps in uncemented holes. Every refuse of this kind should be systematically and regularly removed, and never allowed to soak into the ground.

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* Scotch for "dung-heaps" accumulated in a pit, or simply excreta and refuse of all kinds heaped up on the ground.

The ground ought, in fact, to be secured against every source of contamination. Paving of all streets and courts, so as to prevent surface impurities from soaking in, and great care in the construction of the public sewers, so that they may allow no outflow, will keep the soil of a city free from those impurities which under the influence of heat, water, and air generate injurious effluvia, which may be sucked into houses, or may soak under them. It is necessary also to have rules about "made ground." Inequalities in the surface of the ground are often levelled by filling in with refuse of all kinds—cinders, house and chemical refuse, and dredgings from rivers are sometimes used. Decomposition goes on in such soils, and eventually they purify themselves; but for this time is required. In the cinder refuse of Liverpool, which is tolerably free from impurities, at least three years are required for the disappearance of the more easily decomposed animal and vegetable matters. In other made soil it may be longer, and when soil is very impure, as in the case of old graveyards, it is uncertain how long it is before it would be safe to build upon it. Every made soil should be well drained, so that air and water may freely pass through it, and it should have been laid down from two to four years before being built upon.

The permeation of coal gas from pipes is a

point to be guarded against, and the ease of preventing this would be much increased by the use of subways, the objections against which are more theoretical than practical.

With respect to the means of covering the pathways of city streets, good stone paving is essential. It not only hinders the evolution of effluvia from the ground, but it greatly increases the ease of cleaning the surface. In many Acts full powers are given for that purpose.

The question of the best kind of town roadway for horse and carriage traffic is not quite so easily settled. There are four principal plans—macacadamizing, granite blocks, wood and asphalt. As a mere matter of health the two last are preferable—there is less débris, greater ease of cleaning, and less noise. Both macadamized and granite block roads soon get worn into fine mud, which is made up of finely comminuted stone mixed with earth and droppings from horses, &c. In wet weather this is washed into the sewers, which it aids in obstructing, and it forms a useless part of the sewer water. In dry weather it becomes pulverized, floats in the air, and is one of the ingredients of city air, from which it is deposited as dust on buildings, and has been collected and analysed. Wood and asphalt break up much more slowly, and are more easily cleaned both by rain and by washing. Eventually,

after many trials in and about London, preference is given to wooden pavement for the streets and roadways, laid with asphalt in a particular way on a prepared basis.

2. *The Arrangement and Building of Houses.*— The arrangement of houses and of streets in towns is influenced by many circumstances. A good return for money, facility of locomotion, and beauty are the chief considerations in new towns. In old cities questions of defence and of materials have especially regulated the size and direction of their streets, and the height and compression of their houses. Many considerations will always influence the formation of streets, but it seems evident that a free passage of air to all parts of a town is a cardinal point which should receive the utmost attention. The more numerous and the wider the streets are, the less impeded will be the air flow; in no case should a street be less in width than one and a half times the height of a house.* There should be open spaces at the back of the houses, and all back to back buildings should be illegal. The erection of narrow lanes and alleys should be prohibited in all new towns, and the back courts, so common in our older towns, ought to be gradually removed.

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* In some local Acts the width of a street is fixed at the height of a house, but this is too small.

Open spaces should be provided at intervals, and streets should be so arranged as not to allow any stagnant wells of air between the houses. Wide straight streets are useful for ventilation, and for the laying of pipes and tramways. Straight lines are by some not considered beautiful, but they are certainly most convenient, and the appearance of a street is really much more influenced by its width and by the architecture of the houses than by its direction.

In all these points the law gives some power, both in the Public Health Act of 1848, and in some later Acts, which give permissive powers to sanitary authorities to purchase dwellings in order to improve streets, to set houses farther back when rebuilt, &c. There are also several Local Improvement Acts obtained by some large towns, giving large powers of demolition and reconstruction. It seems, however, important to make very stringent rules on all these points, as it is quite certain many portions of our old towns must be gradually rebuilt, and that many new towns will spring up in the course of the next century, for the proper construction of which due provision should be made beforehand. As it is impossible that towns shall be properly built on hygienic principles if these matters are left to owners of property and to builders, it seems a clear case for the community at large to

regulate matters so important for the general health.*

It is not possible to state with any precision the number of persons who should be located on an acre. This will depend entirely on the construction of the individual houses, but it may be laid down as a general rule that whatever be the size of the houses the amount of ground not occupied by them in any given area should be considerably in excess of the amount actually taken up by houses.

An important point to determine is the height of the houses. In this country a large proportion of our towns consist of low brick houses ; if these are not too crowded, they give a good distribution of the inhabitants, and oppose little obstacle to the current of air. When the houses are very lofty the air currents must be much more impeded, and therefore the streets ought to be much wider and open spaces here and there more carefully provided.

The construction of separate houses is not

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* As an instance of the necessity of this State interference, the case of Liverpool may be cited. More than seventy years ago the Corporation was warned by the medical practitioners of Liverpool that the houses then being erected, and their arrangement, must prove unhealthy dwellings. No regard was paid to this, and now Liverpool will have to undo, at enormous cost, what might at the time have been put a stop to with ease.

usually considered a matter of municipal control, except that certain rules as to ground-plan, foundations and arrangement of closets, and the thickness of party walls are in most towns enforced in respect of new houses. It is of course necessary not to make municipal rules which shall shackle design. Yet there are some other points which a municipality may fairly regulate, and does in many cases regulate, in both urban and rural houses. There should be means of ventilation for every room ; no inhabited room should have a borrowed light, but should have a window opening directly on the external air ; every window should open, and especially at the top ; every room should be of good height, not less than nine feet in the smallest houses, and ten and eleven feet in larger rooms ; the closets ought to be arranged in such a manner that, in addition to ventilation of the closet itself, there should be thorough cross ventilation into the open air between the closet and the rest of the house, and this is best accomplished by having projecting portions of the building to contain the closets ; every house should be properly provided with closets in proportion to its population ; there should be proper water supply, with easily inspected storage, if house-storage is permitted, and there should be proper arrangements for the collection and temporary storage of dry house re-

fuse. The municipality should also lay down rules for house drains and pipes as subsequently noted.

All these matters are easy to regulate without interfering too much with the plans of the architect.

3. *The Water Supply.*—In a town with sewers and water-closets it is generally considered that the supply of water per head daily should not be less than twenty-five gallons; and if there are trades using large quantities of water from five to ten gallons additional must be added. If there are no water-closets, from fourteen to twenty gallons per head daily appears to be the amount usually considered sufficient in large English towns.

Many Acts (public and local) regulate water supply. The sanitary authorities of any place have large permissive powers (under the 11 & 12 Vict. c. 63 and the 29 & 30 Vict. c. 90, and other Acts) as to constructing, or buying and maintaining water works, and building and cleansing public cisterns, fountains, &c., and powers are given also to protect watercourses or water-sheds whence the supply is derived. In local Acts powers are also given to insure proper fittings in houses, to carry out constant service, and other points of the kind. The following details are of chief importance to be attended to in towns:—

(*a*) There should be an originally pure and suffi-

cient supply. The great points are to insure that the water is clear or is easily and completely freed from sediments by sand filtration ; and is well aërated, pleasant to taste, and without smell ; that it contains no injurious animal constituents, and cannot be contaminated with excreta of men or animals, or with foul water from houses ; that it contains no injurious amount of vegetable matter (not more than two or three grains per gallon), and that its mineral constituents are of moderate amount, not exceeding sixty grains per gallon as a maximum, and consisting of such mineral matters as are not likely to be injurious. With respect to lime especially much discussion has taken place as to whether soft or hard water (from calcium carbonate) is best for a town. The soft water is preferred for many trades, and is probably best for health, but it is impossible to prove this by statistics, though this has been attempted, and it is certain that the inhabitants of numerous towns using a good chalk water have excellent health ; and it would seem in fact that the question between hard and soft water is not an important one. The great point in choosing a water is in fact its freedom from any chance of contamination with excreta or with refuse matter from habitations.

The sources of supply are natural lakes, artificial lakes, and gathering or collecting grounds, rivers, springs, and wells.

In towns of any size superficial springs and shallow wells are always suspicious sources of water supply, as it is impossible to secure them from the effects of overflows and soakage.

The duties of a medical officer of health should include the supervision of the source of supply, so as to detect and prevent any possible contamination.

(*b*) The water when supplied must be reservoired and filtered. Usually the reservoirs of our towns contain from one to three months' supply, or less if the supply is very constant. The reservoirs require to be well placed, to be clear of trees, and protected from danger of anything being thrown into them. The filters are usually made of sand about three feet in depth, and the water is passed through at the rate of from half to one gallon to every square inch of surface in twenty-four hours. The upper sand of the filters requires frequent cleaning, and should be regularly inspected.

(*c*) After filtration the water is distributed by means of pipes, usually iron pipes tarred or concreted inside for the larger pipes, and then by lead pipes, or what is better tinned lead pipes for the smaller. Both iron and lead, and especially the latter, are dissolved by some waters, and the question whether lead is so is a point which has often to be determined with regard to a particular water. In examining into this point the water should be

taken after it has been in contact with the pipes for some hours. Carried down by these pipes the water is either delivered at intervals to house cisterns, or is supplied on the constant plan without house storage. In the former case the house cisterns should be well made of slate or concrete, should be able to be easily inspected and cleaned, and should have no communication by overflow pipes with any sewers; the overflow pipe should always open in free air above a grating. The greatest care should be taken that the cistern water shall not be contaminated by absorption of foul air or by leakage, and the cistern should be well covered to prevent dust getting in.

If the constant system is in force it should be truly constant, for if the water is cut off and the house pipes are then emptied foul air must be drawn into them. Even dirty water from a pipe dipping, for example, into a closet pan has been sucked in, and in this way excreta have not only passed into these house pipes, but have even got into the mains. In fact too great care cannot be taken in thoroughly guarding water pipes and cisterns in every way.

Of the two plans the constant system is usually considered the best; but if in use, small cisterns for water-closets and kitchen boilers still require to be used, and, as already said, the supply should be truly constant.

The sources of contamination of drinking water are very numerous, and may affect the water at its source, in its flow, in the reservoir, or during distribution. If stored in houses, it is especially exposed, and this is the grand argument for constant service, as the water is then supposed to be delivered immediately after filtration. If cisterns are properly made and placed, and are regularly cleaned, there are some advantages in house storage, but for low-rented houses it is not easy to provide good cisterns, and therefore the constant service is best for the houses of the poor. Siphon filters of animal charcoal placed in cisterns filter the water immediately before use, and are much to be recommended.

In all towns the service should be at high pressure, so that water may be carried to every floor, and thus labour be spared. In many towns, however, the water is not carried into the houses, but is in "hydrants" or stand-pipes in the street, and is then fetched by the people. It is then stored in the houses in buckets, and is thus often exposed to chances of impurity. It ought, therefore, to be carried into the houses, as is indeed contemplated by the Acts 11 & 12 Vict. c. 63, and 29 & 30 Vict. c. 90.

A town requires water for public purposes, such as for public baths, wash-houses, flooding and washing streets, flushing sewers, and putting out

fires. Powers are given in several Acts for carrying out these objects—especially the Bath and Wash-houses Acts 9 & 10 Vict. c. 74; 10 & 11 Vict. c. 61.

4. *The Disposal of Dirty House Water or Slops and of Dry Refuse.*—After being distributed and used in houses or trades, the water must be carried out of the town. This requires much care. In houses there should be convenient sinks and trapped pipes, so that the inhabitants should have no difficulty in getting rid of the dirty water; if persons have to carry water long distances to get rid of it, the use of the water is always restricted, and the same water is used several times for cooking and even for washing. It must be carried from the houses in pipes or sewers, and then disposed of at the outfall in some way. House water is always impure, as it carries off the cooking water, that used for washing persons, clothes, and houses, and it also invariably contains some portion of the urine. It, therefore, is not fit to be at once discharged into streams, but as its fertilizing powers are small, it is not well adapted for irrigation or precipitation. The best plan appears to be to filter it by intermittent filtration on a small area of properly prepared and drained ground, and then to carry it into the nearest stream.

The dry refuse of houses consists of cinders and ashes, remains of food, dust from sweepings, and various other used articles of house life. In some

towns there is little difficulty in disposing of this refuse ; after being carted away it is sorted, and every article finds a sale. In other towns, however, the disposal of the house refuse is a matter of difficulty and expense. In some towns the dry refuse is placed every day by the inhabitants in front of the house, and is removed by scavengers. In other cases there is storage of refuse on the premises ; if this is done, every house should have a properly prepared dust-hole, well paved to prevent soakage, well covered so as to be kept dry, and so placed as to be convenient for the house as well as for easy removal by the town scavengers. In the building of any houses the arrangements for the position of the dust heaps are almost as important as those for the closets. The removal ought to be frequent, but this has to be fixed by the special circumstances of each house.

5. *The Removal of Excreta.*—The excreta of the skin and lungs are got rid of by ventilation and washing, so that the heading refers only to the solid and liquid excreta, which average respectively (for both sexes and all ages) about $2\frac{1}{2}$ ounces avoirdupois of solids and forty fluid ounces daily for each person.

The excreta ought not to soak into the earth or to remain near dwellings. In towns above 10,000 inhabitants it seems now clear that there is no possibility of using the earth, or any deo-

dorizing plan, on account of the expense of transport. Therefore, three plans only remain—viz., 1. The dry plan, with frequent removal, with perhaps such deodorization as the ashes of the house may give; this is the so-called "pail system" in some one of its forms; 2. The water system, the excreta being carried off in the house water, for which sewers must be provided; 3. The air or pneumatic system of Captain Liernur, in which the excreta are sucked through pipes into central reservoirs by an air pump worked by a steam engine.

It would not be possible to discuss here the relative value and the technical details of these three plans, and, in fact, local circumstances must always decide between the pail and the water systems; the pneumatic plan is now being fully tried on the Continent, and in a few years there will be reliable data as to cost for original plant and for maintenance, also as to its efficiency and certainty of working, and as to returns from sale.

Both the pail and water plans are largely used in England. The former is used in towns where the barbarous cesspit and midden plans are abolished, and yet where proper sewers cannot be made, or water is deficient, or land cannot be obtained for irrigation or filtration. It has the disadvantage of keeping the excreta for some days in or near the house, and is sometimes attended

with a nuisance in working ; but on the whole it is capable of keeping a town clean when it is properly carried on, and it is an immense advance over the old midden system, which retained the excreta in the very midst of the people. It is said also that typhoid fever is less common in towns with a good pail system than in sewered towns. But it is essential that the removal of the excreta should be frequent—*i.e.*, once a week or ten days. After removal the excreta are applied at once to land or are made into "*poudrette*."

The water system is more complicated, and probably more expensive, but if properly carried out is more effectual. If a town can make good sewers, and has water for flushing, and land through which the sewer water can be passed, the water sewerage is the best for health and for economy.

It is essential, however, that the sewers should be well constructed, and should allow no deposit, and that they should be thoroughly ventilated. Deposits are prevented by having egg-shaped sewers, with a proper fall ; easy means of access for inspection and cleaning, and a regular flow of water, with periodical flushing. Ventilation is best effected by having numerous openings, as many, in fact, as can be made, so as to allow constant and free interchange between the sewer air and the atmosphere. These openings may be

street-gratings or shafts, according to circumstances; ventilation through furnace chimneys can be sometimes done, but may be considered as a mere local measure. The openings may, at certain points where the shafts or gratings are near houses, have to be guarded by trays of charcoal, through which the sewer air passes.

This free ventilation causes the air of sewers to be often as pure as the outside air; but this cannot be always insured, and, therefore, in order to prevent the reflux or suction of the air of the public sewers into houses, the following arrangement should be rendered imperative. At some point between every house and the main sewer there should be complete air disconnexion, so that any reflux of the sewer air may pass into the open air, and not into the house. If this were done, the spreading of disease by town sewers would be impossible. The community should construct the main sewers, but it would seem just that the owners of house property, who provide the house drains, and are obliged by law to connect them with the sewers, should be compelled to put down one of the open air-traps which renders reflux impossible into their houses.

With regard to the disposal of the sewer water, three plans can be followed, in the case of towns which cannot discharge at once into the sea or a large river. *First*, precipitation at the outfall,

with a chemical agent, such as lime, aluminous compounds, phosphate of lime, and alumina, clay, &c. A great number of chemical agents have been proposed, and several clarify the water fairly, but none yield a deposit which pays the expenses, either as manure or when burnt into cement. Precipitation must, however, be had recourse to when land cannot be obtained. *Second*, irrigation, one acre being sufficient for the excreta of about 100 persons. *Third*, intermittent filtration, when one acre is sufficient for from 2000 to 3000 persons; the land receiving water six hours out of the twenty-four, and being deeply under-drained. In neither case is there any great profit, but still there is some; and the purification is more complete than by precipitation.

It appears certain that neither irrigation, sewage farms, nor filter beds, are hurtful to the public health when properly managed.

Sewers have been much objected to by some persons on account of the occasional spread of typhoid fever and diarrhœal affections, and perhaps of cholera and diphtheria by their agency; but if properly arranged, and with air-disconnexion between the sewer and houses, there would be no danger, and it is difficult in any case to see how sewers can be replaced. The house water must be carried off; and it is impure, even if no excreta are allowed to flow in. Even if the pail or pneu-

matic plan were to be adopted, there must still be town sewers.

If properly constructed and managed, however, sewers certainly ought to be wholly beneficial to the public health ; they dry the soil, carry off all liquid refuse at once from houses and, if well ventilated, discharge their air into the external free air at points where no injury can result. It seems certain that when a town is well sewered the prevalence of enteric fever is lessened, and diarrhœal affections are also more uncommon. The drying of the soil also lessens destructive lung diseases. Sewers appear to be a necessity, and except in certain cases it seems probable that no better plan of getting rid of excreta than by passing them into sewers can be found.*

The law is more explicit about sewers than on any point of public health. This arises from the great attention paid to the subject by the authors of the Public Health Act of 1848 (10 & 11 Vict. c. 63). The immense evils of the cesspit and midden system seemed at that time only capable of being removed by the adoption of the water-closet and sewer plan ; the difficulties connected with the clogging of sewers, with the reflux

* The Liernur, or pneumatic plan, has been highly praised, and appears in Holland at present to work well, but it is too soon to express any decided opinions on its relative value compared with sewerage.

of gas from them, and with the disposal of the sewer water at the outfall, were not fully recognised. Still, the movement was in the main not only judicious, but necessary, and has been beneficial in its effect on public health. The legislature of 1848 has been followed up by the Nuisances Removal Act of 1855 and its amendments, the Sanitary Acts of 1866 and of 1872, and by several other public and many private Town Improvements Acts.

6. *The Conservancy of the Surface Area.*—The cleansing of the surface area of towns is secured partly by powers given in the Sanitary Acts, in Local Acts, and especially in the Nuisances Removal Act of 1855 (18 & 19 Vict. c. 121) and the subsequent amendments (23 & 24 Vict. c. 77 and its amendments). These powers are large, and on the whole sufficient. Public streets of all kinds can be easily kept clean, but nuisances on private premises may escape observation until complained of. Under these and other Acts the supervision of pigsties and stables is carried out, and in fact any condition which can give rise to nuisance or can be considered injurious to health can be legally dealt with.

The sanitary importance of thorough surface cleansing is obvious; the mud and dirt of towns and refuse of all kinds, wetted by rain and exposed to heat, soon decompose and give out effluvia which must be injurious to health, especially in

narrow courts and lanes where the movement of air is impeded. The excellent effect on health of paving a town has been often observed, and a large share of the benefit is certainly owing to the constant removal of surface garbage, as well as to the impediment given to the passsage of air from the impure ground.

7. *The Supply of Food, including the Regulation of Slaughterhouses, Cowhouses, and Bakehouses.*—A very important duty of a municipality is to supervise the food of the people. While the price and quality must be left to the ordinary operations of commerce, the responsibility of preventing falsification and of insuring that the article shall not be injurious to health must rest on the sanitary authority. The regulation of slaughterhouses and knackers' yards is directed by the Public Health Acts of 1848 (11 & 12 Vict. c. 63), and of 1858 (21 & 22 Vict. c. 98), and other enactments. Private slaughterhouses are licensed, and can be visited and subjected to bye-laws.

All slaughterhouses require careful supervision as the trade is a dirty one, and as many private slaughterhouses are constructed out of buildings intended for other purposes and not fitted with proper appliances. They are also generally placed in the densest part of the town. The evils attending them are gradually being removed by the erection of public slaughterhouses, where abundant

air, water, good sewers, and means of cleansing are provided. The custom also of slaughtering in the country and then sending the meat to cities is increasing, and this renders private slaughterhouses less necessary. Still they exist in all large towns, and difficulty is felt in getting rid of them.

Cowhouses are usually inspected under bye-laws of the sanitary authorities based on the Nuisances Removal Acts or on private Acts. A certain cubic space is allowed to each cow (1000 cubic feet should be the minimum), and cleanliness is enforced. The condition of small cowhouses and the dairies attached to them requiries more attention than it has received, as both enteric and scarlet fever are now known to have been spread by the agency of milk. Bakehouses are regulated under a special Act (26 & 27 Vict. c. 40) which was passed in 1863, after an inquiry into the condition of the trade. By this Act the bakehouse is ordered to be kept in a cleanly condition, to be properly ventilated, protected from effluvia arising from drains, privies, and the like, and not to be used as a sleeping place. The condition of the bakehouses disclosed by the inquiry referred to was in the highest degree disgraceful and repugnant. The inspection of the chief articles of food takes place under the Public Health and the Nuisances Removal Acts in respect of meat, fish, fruit, vegetables, corn, bread, and flour, and under the Adulteration and

Licensing Acts in respect of other articles of food.

The following are the chief points in each case: (1) *Meat.*—Much doubt exists as to the extent to which the condemnation of meat exposed for sale should be carried. There is no doubt that meat sufficiently decomposed to be discoloured and to have a putrid smell, and meat with abscesses and suppurations should be condemned; but the difficulty arises with meat apparently sound or not very obviously otherwise, but which is derived from diseased animals. Though opinions differ on this point it may perhaps be said that meat derived from animals dead of inflammatory diseases and of epidemic pleuro-pneumonia may be used, but that beef from cattle dead of cattle plague and anthrax (malignant pustule), mutton from sheep with small-pox and splenic apoplexy, and pork from pigs with carbuncular diseases, hog cholera, hog typhus, and scarlet fever, should not be used, although it is not easy to give conclusive evidence as to the injurious effect as to health from the use of the meat in some of these cases. Opinions are also much divided as to whether the flesh of braxy* sheep or of cattle dead of foot-and-mouth disease should be used or not.

* The term "braxy" is so very vaguely used, that it is difficult to define the disease meant by the name; and in different parts of the country totally different disorders are included

In the parasitic diseases of animals the question is easier ; it is of course highly improper to use pork with trichina. Cysticerci in pork, beef, and mutton should also in my opinion be a valid ground for not permitting the sale, though this view is not universally or perhaps generally held ; since as cysticerci are killed by a temperature of 160° Fahr., it is considered that good cooking removes all danger, and therefore that condemning meat for this cause is an improper restriction on supply. On the other hand, as it is impossible to secure that a sufficient temperature shall be applied, how can it be possible to prevent the development of tapeworms if the sale is permitted ? The prohibition would probably not long affect supply, as the breeders and salesmen would take greater care in preserving the cattle from parasitic infection ; and that this can be done by supply-

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under the name. One disorder is an intestinal affection, attended with obstinate diarrhœa ; the other is a blood disease, and is spoken of by the shepherds as true braxy : death is sudden, generally by convulsions, in about five or six hours (sometimes within one hour), after the first symptoms of disease. If the sheep's throat is cut before it ceases to breathe, so that the flesh is well freed from blood, there is an absence of any peculiar appearance of the flesh ; and the body of the sheep generally looks so well that the mountain shepherds in Scotland usually cut it up to make "braxy-mutton." But if the sheep is allowed to die of itself, its body swells, rapidly putrifies, and is unfit for food. In warm climates the disease assumes a malignant type, and constitutes a carbuncular disease.

ing pure water and clean food is shown by the experience of the Commissariat in Upper India.

Flukes in the liver do not constitute a valid ground of rejection of the meat, though the liver ought not to be eaten. The inspection of fish and poultry and game is merely for signs of decomposition.

Sausages when musty and strong smelling should be rejected ; but owing to the spices used decomposition is not easily made out, and the peculiar poisonous sausages are undetectable.

(2) *Wheat, Flour, and Bread.*—The chief points are to ascertain that there is no ergot, no fungi nor acari; that alum has not been used, and that cheaper grains or mineral matters are not mixed with it.

(3) *Other Articles of Food.*—Under the Adulteration Acts the following, among other articles, may have to be examined. Milk (addition of water, removal of cream, or falsification in other way, or presence of blood, pus, casts, and fungi); butter (admixture with foreign fats, excess of water or salt) ; cheese (decomposition, mouldiness, addition of copper); coffee (decomposition or mixture with chicory, wasted corn, &c.); tea (decomposition, mixture with exhausted leaves, leaves of other than tea plants, sand, iron ore, colouring matters or facings) ; cocoa (addition of arrowroot, exhaustion of fat, &c.) ; oatmeal (addition of inferior barley, wheat, or maize); Maranta arrowroot (addition of potato starch

or inferior kinds of arrowroot); spirits, wine, and beer (addition or subtraction of spirit, improper spirits, as methyl or other alcohols; addition of water, salt, sulphuric acid, ferrous sulphate, lime salts, lead, cocculus indicus, hot spices, aloes, quassia, burnt sugar, &c.);* vinegar (addition of water and excess of sulphuric acid).

In no case is an examination of food under the Adulteration or Licensing Acts made to determine the quality of a pure food, it is directed simply to detect the presence and amount of foreign substances, or of decomposition and putrefaction. The law permits mixtures to be sold in some cases if the admixture is stated on a label.

All the arrangements connected with the supply of food so as to insure that it is delivered in a sound and good condition, are most important points in public health, and great attention should be paid to them by the medical officer of health.

8. *The Regulation of Trades and Sale of Alcohol in its Various Forms.*—Trades are affected by the law under two points of view.

1. Irrespective of the nature of the trade, the

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* The examination of adulteration of beer is so far difficult, as the law now allows other bitters besides hops to be used, and it is understood there are numerous cheap bitters now used in place of hops. It is very desirable that the old law, allowing only malt and hops to be used in the making of beer, should be re-enacted.

place where it is carried on is regulated under the Mines, Factories, and Workshops Acts, and by a clause in the Sanitary Act of 1866 (29 & 30 Vict. c. 90). The object of these Acts, among other things (such as restriction of labour at certain ages) is to provide that the common conditions of health are not violated. This is a very necessary point, for many workshops are deficient in light and air, are badly ventilated, or are rendered unhealthy by gas burnt for light. Many small workshops are owned by men of small capital, who often sacrifice the health of the men by compelling them to work under very unfavourable conditions. Happily these faults are usually easily remedied by a little common sense and simple appliances, and in this respect the Workshop and Factory Acts have done great good. One special fault in many workshops is, however, still common—viz., the burning of gas in large quantities in dark shops, without proper means of carrying off the products : the very great influence for evil on the lungs of this condition was long ago pointed out by Dr. Guy.

2. The other point in the regulation of trades is to prevent any of the processes being nuisances or injurious to the health either of the workpeople or the inhabitants of the surrounding districts. This is an extremely wide subject. Trades create nuisances (*i.e.*, conditions which, not necessarily

injurious to health, yet annoy and inconvenience the public), such as offensive effluvia, dust (black smoke may be included in this term), and acid vapours which destroy vegetation. They may be also injurious to health, especially those (and they are very numerous) which give rise to dust in the air of any kind. Cotton and woollen débris, metallic vapours, filings and grindings, particles of size, clay, dry paints, and many other substances come under this head. Much debate has taken place as to whether certain gases, such as carbonic acid, chlorine, iodine, sulphuretted hydrogen, sulphurous acid, or the fœtid vapours given off from catgut, gelatine, manure, and other trades are or are not injurious to the health of the workmen. In many cases the discussion is not closed, and fuller inquiries are necessary, but at present it seems as if both gases and fœtid substances, however disagreeable, are not proved to be unhealthy (though their innocuousness cannot be asserted), while there is no doubt that the inhalation of all solid particles, wherever derived, is highly injurious. In certain cases there appear no doubt of injurious results being educed, as found in match manufactories when phosphuretted fumes were allowed to escape into the air.

There is one article the use of which gives rise, directly and indirectly, to a large amount of sickness, and the trade in which certainly requires

regulation if the public health is to be regarded. I refer, of course, to the sale of alcohol in its various forms. Owing to peculiar social customs, and to the insufficient recognition of the immense amount of harm produced by excess of alcohol, and to a want of definition of what is excess, the laws of this country have not only legalized the sale of a dangerous article of diet, but have actually encouraged the sale, until an evil so gigantic has been produced that no one can suggest a reasonable remedy. Yet the sale of alcohol is so distinctly a source of disease that it must be considered by those who have charge of the public health, and in some way must be restricted. One source of legislative error seems to be that alcohol is regarded by the State not only as a source of revenue, but as an indispensable article of refreshment. There is, of course, no question that the public must be supplied with houses where they can obtain proper refreshments, such as meat, bread, vegetables, milk, coffee, tea, or other articles of the kind ; and public-houses were intended to supply articles of this description, as well as alcoholic liquids, which enter into the ordinary diet of most people ; yet, unfortunately, a system has grown up by which our public-houses have become only places where alcoholic liquors are sold, and this is defended on the ground that such liquors are refreshments. The

amount of temptation which has been put in the way of our working classes by the heedless multiplication of these grog shops during the last forty years accounts for much of the drunkenness which so deeply affects our national life, and injures the health of the people. A remedy ought to be and must be found for this state of things, or else sanitary legislation will still present the absurd spectacle of raising up with one hand what it is smiting down with the other.

9. *The Arrest of the Contagious and Infectious Diseases.*—Among children, small-pox, scarlet fever, measles, whooping-cough, diphtheria, and enteric fever; among adults, enteric fever, typhus, small-pox, relapsing fever (when epidemic and severe) have to be dealt with.

Among other contagious diseases also syphilis and gonorrhœa must be included.

Of late years, since the recognition of the fact that all these diseases must have special causes, the prevention of the infectious diseases has become much easier, although the exact nature of the cause may be unknown. The general principles on which the prevention is based are:—1st. The recognition of the places of origin or conditions of growth of the morbid agent—*i.e.*, whether it arises from processes going on in some of the structures of the human body, or in substances outside and independent of the body, and under

what states of heat, moisture, &c. ; if these points are known, the formation of the agent can be prevented, or the agent can be destroyed. 2nd. The recognition of the means of spread of the agent—*i.e.*, whether it spreads by the help of the air, or is carried in drinking water, or in food, or is transferred directly from one person to another, that when known the carriage of the agent may be stopped. 3rd. The early removal of the agency from among the community, so that the risk of spreading in any way may be lessened.

In the case of each of these diseases the preventive measures are different, and it is impossible here to go into so large a subject as the prevention in each case. The measures include a continual supervision over the conditions of origin, introduction, and spread, as far as they are known.

Two points must, however, be specially noted. The isolation of persons ill with any disease which directly or indirectly can spread from one person to another is a necessary step in all cases. In the crowded houses of towns some diseases, such as typhus, scarlet fever, measles, relapsing fever, &c., spread with great rapidity, and the only possible check is to remove the sick at the earliest moment from the house, and to prevent persons ill with infectious diseases from exposing themselves in public places and conveyances.

For the first purpose sanitary authorities have

powers (29 & 30 Vict. c. 90) to remove persons ill with infectious diseases to a proper hospital in special conveyances; to prosecute sick persons frequenting public places or conveyances; to destroy bedding or clothing, and to disinfect rooms, houses, or clothing. Hospitals for infectious diseases are now being constructed in many towns; it is desirable to make them simple cheap buildings of wood or iron, able to be thoroughly cleaned or, after a term of years, destroyed and replaced. The arrangements in these hospitals are as usual a cubic space of from 1500 to 2000 cubic feet, and a floor space of 120 to 140 feet is recommended. The freest ventilation, supply of water, and means of disinfection are essential. Under the same Act a town is empowered to erect a proper place for disinfecting clothing and bedding; disinfecting chambers (heated by hot air, steam pipes, or gas, and in which a heat of 240° Fahr. can be reached) are now provided in many towns for the immediate disinfection by heat of all soiled clothes taken from patients with any of these diseases.

The disinfection of the excreta, or of discharges from the body, or of the air surrounding sick persons is also attempted, and is evidently a proper plan to follow, though the results are at present uncertain. The spread of scarlet fever, however, appears to be arrested by rubbing the

skin with carbolized or camphorated oil ; typhoid fever is probably stopped by strong chemicals added to the intestinal discharge, and the spread of typhus has been also lessened, and perhaps arrested, by aërial purifiers, especially nitrous acid fumes.

In the case of any infectious disease assuming epidemic proportions, the Local Government Board must put in action for six months the Diseases Prevention Act (18 & 19 Vict. c. 116 and 23 & 24 Vict. c. 77), which give large powers to the sanitary authority with respect to speedy interment of the dead, house to house visitation, supply of medicines and attendance, and special regulations on the best mode of dealing with the emergency.

Small-pox is prevented by vaccination, but for this there are special Acts and a special organization.

The prevention of syphilis and gonorrhœa by periodical inspection of prostitutes, and removal of them to lock hospitals when diseased, is only carried out in this country in certain military and naval stations, where the effect has been to lessen primary syphilis by nearly one-half, and to abate its virulence. The effects of the Contagious Diseases Acts upon the women, in respect not only of curing them, but of influencing them for good and for reclaiming them, has been very re-

markable. In Germany, France, and Belgium precautions against venereal diseases have been carried out among the entire population for many years with the effect of greatly lessening the amount and virulence of syphilis.

As primary syphilis has a most pernicious effect upon the health of a very large number of persons, it is most urgently to be hoped that the Legislature may before long deal thoroughly with this matter, and attempt to lessen syphilis, not merely in the army and navy, but among the population at large.

10. *The Disposal of the Dead.*—Two points are involved in the disposal of the dead both in towns and villages.

1. In this country where so many families live in single rooms, and where the custom of keeping the dead five or even six days before burial is usual, it constantly happens that a corpse is kept for days in the room where all the family life is carried on. As decomposition, especially in some diseases, commences early, it cannot be doubted that an unfavourable effect on health must be often produced. To avoid this detention, mortuary chapels ought to be constructed in all towns and villages, to which all corpses should be removed from the homes of the poor within thirty-six hours after death.

Power has been long given (11 & 12 Vict. c.

63, Public Health Act of 1848) to the sanitary authority to provide mortuaries and to remove corpses from rooms where persons live and sleep when such is necessary to prevent disease (29 & 30 Vict. c. 90), yet very little has yet been done in this way, and England is in this respect far behind some of the Continental States. Mortuaries are real necessities in every inhabited place, and should be provided. The custom which is universal of keeping the corpse unburied for nearly a week ought to be altered, even in the case of the better class of houses; no corpse should be unburied more than three or four days, and in hot summer weather the interment should be still earlier.

2. The second point is the disposal of the corpse. The law of England now allows no burial grounds in large cities nor burial under churches, and consequently cemeteries are provided at convenient distances from towns. These cemeteries ought to have a dry soil, so that the ground water shall never rise high enough to meet the corpse, or to float it up in the vault, as sometimes happens; there should be good drainage, and the water should not run into any watercourse from which drinking-water is taken; the site should be well ventilated and well planted, so that the roots of plants may absorb the decomposing matter; the kind of soil will of course depend on the locality, and in many cases there is no choice; but if there be a choice,

a marly soil, not too stiff, but allowing free percolation of air and free flow of water, should be chosen ; gravelly soils act pretty well, but are said to form a compact mass round the body which prevents access of air and moisture ; lime and chalk soils act better, and especially if the soil is alkaline, and hence the advantage of covering the body with quick lime ; very stiff clay preserves bodies longer than the less compact soils.

Bodies decay in very various times according to soil, access of air, amount of pressure, &c. In some cases a corpse may be destroyed in three years, but as a rule, when ground has to be used over again, a period of from five to thirty years is allowed in different countries before re-interments. Bodies should be buried deeply (four to six feet) in order to lessen the chance of contamination of the air, though it is supposed that when the graves are shallower decomposition is more rapid ; the graves should not be bricked, but the earth allowed to rest on the coffins. It has been proposed not to use coffins but sheets or wicker baskets so as to let the earth come at once in contact with the body, and in fact, in many villages in England it was formerly the custom to carry the corpse in a coffin to the churchyard, there to remove it from the coffin and place it in the ground in a sheet. If the coffin is not made too strongly, it is probable that

it does not much delay decomposition, so that this point does not seem very material.

The decomposition of bodies occurs by putrefaction, with rapid disengagement of effluvia by a sort of insensible decomposition, the products being arrested or decomposed by the earth and by saponification ; this last condition is said especially to occur if the earth is too closely pressed on the body and gets too saturated with the products of putrefaction.

Owing to the contamination of air over cemeteries, these should be at a certain distance from houses ; one hundred feet is the least distance laid down by any Government, but probably it should not be less than five hundred feet. Owing to the possibility of water being contaminated, great care should be taken of the drainage.

As in some cases conveniently situated and proper land cannot be obtained, a discussion has lately arisen whether burning, or in the case of seaboard towns burying the body in the sea, might not supersede burial in the ground. This, however, is not the place to enter into the consideration of these questions.

II. Hygienic Conditions of Villages.

Although many of the enactments referred to in previous pages might have been applied to villages, it was not until the passing of the Public

Health or Sanitary Act of 1872 (36 & 37 Vict. c. 79) that rural sanitary authorities were constituted. These authorities—viz., the rural poor law unions, can now exercise considerable powers, and if properly set in action by their medical health officers and inspector of nuisances (whom the authorities are obliged to appoint), a great effect must be gradually produced upon the rural labouring class whose condition has up to this time been almost entirely neglected. As in towns, the rural sanitary authority may provide water, may make public cisterns or baths, may protect watercourses, may construct sewers and dispose of sewage matter, must take care that no closet or privy is a nuisance, may clean ditches and remove refuse, and may make regulations as to cellar habitations and common lodging-houses. All powers possessed by urban authorities as to trades, sale of unwholesome food, removal of nuisances, providing mortuaries and hospitals for infectious diseases, are now also possessed by the poor law unions.

At present, however, except in those places where several rural sanitary authorities have united to appoint a first-class sanitary officer, little has been done in the English villages.

The problem of rural sanitation is in fact by no means an easy one, but it is being vigorously discussed, and will be no doubt eventually solved by the officers of health of large areas, many of whom

are men of great knowledge and distinction. The difficulty arises from the houses in the rural districts being, in a great number of cases, old, dilapidated, unsuited for dwellings, and destitute of proper conveniences. When new houses are built, the sanitary authority can enforce certain provisions, but in the case of houses already built its power is limited. Then there is very little money available for improvements, the poor rates are already often heavy, and guardians hesitate to increase them. The small number of houses in villages also in comparison with the outlay for sewers and water supply renders the cost per head relatively much greater than in towns. Progress, therefore, in rural districts must be slow, but yet it cannot be doubted that the present condition will be gradually improved.

In addition to the bad construction and dampness of the houses, the sanitary defects of villages are as follows :—The water is too often drawn from shallow wells, or from small streams polluted by soaking, or from stagnant pools or ditches, and its supply is limited. Often there are no means for carrying away the dirty house water, and it is thrown on the ground, and soaks into the soil close to and under the cottage. The excreta are generally thrown into an ashpit near the house, or pass into a cesspit in the ground, into which they gradually soak, polluting both

ground and water. All appliances are in fact often wanting. Attempts are now being made to purify and then to guard the wells, to collect rain water in proper tanks when other sources are wanting, or to store the drainage water, as recommended by Mr. Bailey-Denton). For the disposal of the slop water, open or partially closed surface drains leading to ditches or underground drains allowing the water to flow into the soil before the surface, and other plans have been proposed. It it would seem important, especially if shallow wells furnish the drinking water, to carry off to a distance all the slop water by drains of some kind. For the removal of excreta (as sewers are generally out of the question) a pail system, with or without the use of dried earth or charcoal, according to circumstances, has to be used. If the cottages have gardens, then the simplest dry earth plan, with a proper storage, and the subsequent digging into the garden at intervals of not more than three or four weeks, seem to answer well ; yet it is very difficult to get peasants to attend even to this simple matter. If the village be a large one, then conjoint action in the procuring, drying, and distributing the earth, and in the removal of the mixed earth and excreta answers well when care is taken. In other cases a pail system with weekly or fortnightly removals without the use of earth or other appliance can be

employed, and may answer, as the manure has some value.

These seem at present the directions in which the opinions of medical officers of health are tending when villages and labourers' cottages are concerned, and where larger works cannot be undertaken. The object of course is to obtain at a cheap and not too burdensome a rate the same results which are arrived at in towns, by more costly plans—viz., to insure pure drinking water, and to remove foul house water and excreta, or, in other words, to insure purity of the water, of the air, and of the ground.

III. Hygienic Condition of Houses.

The inside of a house is supposed to be beyond the control of the Public Health Authority, and it is so to a large extent, but not altogether. The law issues regulations on this point in the following cases :—

1. Common lodging-houses are registered and inspected, the number of lodgers is fixed, and ventilation and cleanliness and water supply are attended to. A certain cubic space per head is fixed by the sanitary authority. In the metropolitan lodging-houses 240 cubic feet, and in Dublin and many other towns 300 cubic feet are allowed.

2. *Cellar Habitations.*—Since 1848 no new cellar habitations have been used, unless they are in accordance with certain conditions of space, height, window area, &c.

We owe these regulations on lodging-houses and cellars to the great Public Health Act of 1848 (11 & 12 Vict. c. 63), the authors of which were evidently profoundly impressed with the great evils of overcrowding. This and subsequent Acts (Common Lodging Houses Act of 1851 and Public Health Act of 1875) have made the common lodging-houses much healthier and more decent habitations, have greatly lessened the number of cellar dwellings, and have improved the condition of those still used.

3. *Overcrowding.*—The Nuisances Removal Act of 1855 (18 & 19 Vict. c. 121) empowers the sanitary authority, on the certificate of the medical officer of health, or of two qualified medical practitioners, to take proceedings before a justice to abate overcrowding if the inhabitants consist of more than one family. Some towns have also provisions in their local Acts giving them the same authority, and in this way the immense evil of overcrowding is sought to be lessened. The question arises:—"What is overcrowding?" Usually the common lodging-house rules are taken—viz., an air space of 300 cubic feet per head as the minimum. But there is no legal amount, except in Scotland,

where the General Improvement and Police Act of 1862 enacts that children under eight years shall have 150 cubic feet, and persons over that age 300. It would be very desirable, however, to raise the minimum for persons over ten years to 400 cubic feet, and this is really little enough.

The law then in these three ways acts directly upon houses, and if any nuisance is reported, or if houses are found to be dangerous or unfit for habitation, further powers come into play. Power is given to the sanitary authorities of the metropolis and those of the larger towns by the Artisans' Dwelling Act of 1875 to pull down houses that continue to be "so ingrained with disease" that no expenditure of money can remedy them.

Although public authority extends no further, it seems desirable to say a few words on the

CAUSES OF THE UNHEALTHINESS OF HOUSES.

1. *Dampness* arises from a damp soil; water rising in walls; beating through walls, or coming from a leaking roof or blocked water pipes. Paving, concreting, damp proof courses, hollow walls, cementing, &c., are the remedies. Damp houses are unhealthy from apparently the lowering of warmth giving rise to catarrhal and rheumatic affections, and perhaps to increased decomposition of organic substances from the constant excess of moisture.

2. *Excessive Coldness of Air from Draughts or from Insufficient Warming.*—Although an airy house is the healthiest, there may be, not too much, but too imperfect movement of air, so that strong currents are caused ; or the temperature may be lower than is good for health. At the same time, if persons are well clothed, they can bear much cold. The draughtiness and insufficient warming are matters of construction, and are obviated by proper plans of ventilation and warming. The use of hot water and steam pipes in towns, heated by a furnace common to several houses, will no doubt soon supersede our present inefficient and expensive fireplaces, and since the supply of warmed fresh air is a very simple proceeding when these pipes are used, not only will houses be better warmed, but better ventilated and less draughty.

3. *Impurity of the Air.*—This arises from the following conditions :—Impure air drawn from ground or basement into the house, or over impurities outside house ; air in house contaminated by effluvia from closets and pipes, from products of combustion, from products of respiration and transpiration ; from uncleanliness of persons, clothes, walls, floors, and furniture.

Each of these conditions has to be examined into and rectified according to the usual rules laid down in works of hygiene.

A few remarks may, however, be permitted on some of the headings.

The removal of respiratory impurities can only be accomplished by constantly removing the air of rooms and supplying fresh air. This is ventilation, which, on account of the very mobile character of air and of the ease with which its currents are reversed, is a mechanical problem of no little difficulty. The amount of air required for an adult in order to keep the air free from any odour is 3000 cubic feet per hour; the carbonic acid of respiration, which is taken as a measure of respiratory impurity, should not exceed ·2 parts per 1000 volumes of air, or ·0002 parts in each cubic foot of air. Practically the amount most persons get is not more than 600 to 1200 cubic feet per hour, if so much, and the air of such rooms smells fusty from organic effluvia. In cold times of the year the entering air must be warmed if such great changes are to take place as is implied in the supply of 3000 cubic feet per hour, or in the change of air in the room at the rate of three, four, or even five times per hour. When warmed to nearly the temperature of the surface of the body (80° to 90° Fahr.), considerable movement of air is borne without difficulty; but if the temperature be much lower a much slighter movement is felt. Ventilation in this climate is therefore inextricably mixed up with warming, and thorough

ventilation of our rooms is impossible as long as we trust to radiant heat alone for warmth. The problem therefore which engineers have to solve in warming and ventilating our rooms is :—"What is the cheapest and most constant plan of introducing warm air of a temperature under 90° or 95° into our houses, in cold weather the conditions of the problem being a supply of 3000 feet per hour at a rate of movement imperceptible to the feelings of the persons in the room ?"

Another point concerns the impurity of the air from drains. It is necessary to be certain that the house drainage is so thoroughly air-disconnected with the town sewers that no reflux of air from them is possible, and therefore that if there is any sewage smell in the house it must come either from the ground or from the house pipes or closets themselves. If from the ground, there is a leaky pipe somewhere, and the air penetrates through the interstices of the soil, and is drawn into the house ; every house should have a plan of its drainage so as to facilitate the search for a broken pipe. If not from the ground, the smell may be from some pipe in the house ; this arises from imperfect junctions, especially when metal pipes run into eathenware, or from the pinhole eating away of metal pipes. Or there may be a clogged or imperfect trap with the water,

either sucked out of it or becoming thoroughly charged with fœtid effluvia.

In order to detect any of these conditions, it is necessary that builders should alter all their plumbing arrangements. At present they try to conceal everything, so that without pulling a house to pieces it is impossible to examine if pipes and traps are in order. Instead of this every pipe should be kept out of walls and above ground, and if cased with wood, the case should be merely bolted, and not nailed. If a pipe must be carried under ground it should be laid in a regular channel, which can be opened, but as far as possible all pipes should be above ground and open to sight, and never should run under houses. The sewage and foul water arrangements of our houses will never be satisfactory till these matters are attended to, and till the examination of every pipe about the house can be made without difficulty, and the clogging of pipes, or air and water leakage from them, detected. In closets the points of air leakage are the horizontal pipes and the traps. In all cases the soil pipe should be ventilated by a pipe carried to the open air at some point far from windows.

Another matter to be guarded against in all cases is the immediate opening of the cistern or of the rain-water pipes into the sewer or house drain. The usual rule is to open them into the

sewer and sometimes to guard them above by a sigmoid trap, which, however, is often dry. Sewer air passes up, and enters the cistern or rooms which happen to be near the top of the rain-water pipe. All these pipes should open in free air over a grating, and if every householder would insist on the builder attending to these matters the chances of inflow of sewer air into houses would be much lessened.

Another matter of importance is the way in which the products of gas-combustion are allowed to pass into the air of rooms. Nothing can be worse, and as gas lights may be made a valuable means of ventilation if tubes are arranged to carry off the burnt gas, the present plan of chandeliers is not only hurtful, but is ignorant and unmechanical, and leads to a waste of force.

4. *Impurity of the Water.*— Water delivered pure to a house may become impure on the premises, usually from uncleaned uncovered cisterns, direct leakage from pipes into cisterns, and absorption of air from pipes and drains by the surface of the water. Lead may also be taken up. The remedies for these conditions are obvious.

5. *Impurities from Uncleanliness of the House.*— Walls and ceilings all absorb impurities, which are given out again to the air, and often become highly impregnated with organic matters ; the chinks of floors allow matters to collect below them, and

then air rises into the room; or furniture may harbour dirt, and thus continually contaminate the air.

The custom of repapering walls without cleaning the old paper, the decomposition, and the use of arsenical pigments, may disengage impurities. In the houses of the poor which are not regularly whitewashed, the half crumbling plaster is often highly charged with animal material.

These matters are to be avoided by original good construction or by constant cleanliness. It is a great desideratum to make walls of impermeable materials, so that they may be washed without difficulty, but at present this is an expensive matter.

If these various points, which are really questions of impurities of air and water and of temperature and movement of air, are improperly dealt with, houses must be unhealthy. These are conditions which are not difficult to keep in order if they are clearly understood and if their importance is not underrated. The great point is to have the house air pure, so as in no way to injure or depress the great function of respiration. We must look to the Municipal and Urban or Rural Sanitary Authorities to keep the outer air pure, while the task of doing the same for the house air must necessarily fall on the inhabitants of the house.

VITAL STATISTICS.

The attention now paid to public health is in a large degree owing to the careful collection of the statistics of births and deaths and of the causes of death, which have been collected in England for the last thirty-eight years. It may truly be said indeed, that not only all Europe, but gradually the entire world, has been influenced by the work of the Registrar-General of England. We are now able to determine the limits of mortality and its causes with some precision, and are being led up to the consideration of the causes which bring about a too high death rate.

The chief vital statistics bearing upon public health are the determination of the birth rate ; of the death rate according to sex, age, and disease ; and of the health of each class of the community as judged of by the expectation of life at given ages. There are many other problems, but these are the most important. Statistics of sickness, apart from mortality, are not attempted on account of the difficulty of collecting the data with sufficient accuracy.

The gross death rate, as calculated on the mean population without distinction of sex or age, is that which is commonly used to express the health of a town or district. It is of course to be understood that it is an inferior method to the

further analysis of the data when the diseases and ages are given, and when the birth rate is also known, for the deaths of newly born and young children form always a large item in the list. As far as it goes, it is, however, extremely useful. This general death rate is calculated on the population, the population being ascertained positively by census every ten years, and in the intervals being calculated by adding the known yearly rate of increase and by approximative corrections for emigration. Determined in this way, it was assumed in 1848, when the first Public Health Act was passed, that in this country the health of no community is satisfactory if the general death rate exceeds twenty-three per 1000 of population per annum. And under the provisions of that Act, the General Board of Health constituted by it was empowered, if the number of deaths in any place annually exceeded twenty-three per 1000, to send an inspector to examine into the hygienic conditions of the locality. It would now seem that the number twenty-three might reasonably be lowered to twenty-two or even twenty-one, but no legal or authoritative statement has been made of late years.

The further division of the statistics into the deaths according to age and disease is, however, necessary to form a correct idea of the sanitary state of any district. Unexpected results are

sometimes brought out, as, for example, that a general high death rate may be owing entirely to an extremely high infantile death rate, while adults may be healthy. The cause of the high death rate will then also appear, and will indicate the remedial measures which are necessary. The child death rate (*i.e.*, the death rate for every year of life up to five years of age calculated both on the gross population and on the population at the several ages if that is known) is indeed most necessary to be known in every health inquiry.

Among the poor population of our large cities the deaths of children under five years of age may constitute half of the total deaths at all ages, and occasionally in some bad districts in unhealthy towns the deaths of children have reached sixty per cent. of the total deaths, whereas in all England the child death rate may be only one quarter or twenty-five per cent. of the total deaths, and in healthy districts and good families is below this. Or to put this in other terms, among 100 children under five years of age there may die annually only four among the better classes, and from ten up to the immense mortality of twenty-six in the worst parts of our large towns.

How wonderfully the child death rate is influenced by the higher social position of the parents, which implies greater care of the children,

is strikingly shown by Mr. Ansell's very useful tables of mortality among the upper classes.

Of 100,000 children born alive there are living at the fifth year in all England 74,000 (in round numbers we may say that one-quarter have died); among the "upper classes" (as defined by Mr. Ansell) 87,000 are living at the fifth year, while among the peerage not less than 90,000 are living. As a contrast, I may take a street in Liverpool where Dr. Burdon Sanderson and I found the death rate so high that only 10,000 children would be living at the end of five years out of 100,000, or 90 per cent. had died in five years.

The determination of the diseases causing the infantile death rate (under one year), or child death rate (under five years), or adult or general death rate, is also a necessary part of all these statistical inquiries. So also the birth rate must be considered in connexion with the infantile and child death rate.

The chief diseases causing mortality under five years of age among the poorer classes are diarrhœa and convulsions from bad food, acute chest affections from cold and exposure and vitiated air, and the contagious infantile diseases. Among the older people, phthisis and chest affections, and from time to time outbreaks of infectious diseases, hold the first rank.

The amount of the infectious, or so-called zymotic diseases, must be always carefully noted;

but there are many other preventable diseases quite as worthy of attention, and especially the acute and chronic chest affections, which are largely owing to removable unhealthy conditions of atmosphere and mode of life.

The calculations necessary to bring out the result are of the most simple kind, if the data are known—viz., the number of the population, the sexes, ages, number of deaths, and diseases causing them.

The national census furnishes some of these figures, and the medical profession contribute the rest, and bear therefore a very great responsibility ; for inaccuracy may greatly affect the action of the community, and the measures taken on the faith of the accuracy of the statistics.

The third statistical point to which allusion was made is the length of life a person of a given age may expect to live. This so-called "expectation of life," or "mean after-lifetime," is a good test of the health of a people. It is one, however, which can only be applied at long intervals, and by the aid of very accurate and numerous census and death lists. It is not, therefore, applicable as a daily method of determining the degree of health of a people. It appears, however, that as compared with former periods, the expectation of life is improving in the chief

European countries, and the mean of age at death is also greater than formerly.

By means of vital statistics, then, the causes of death among a people are determined, and by the rules of public health are attempted to be neutralized and overcome. The struggle is never-ending, but is not indecisive. It is remarkable how steadily public health has improved with each new advance in wise legislation. In no case has disappointment resulted ; and in some instances the good results have been really surprising. Much still remains to be done, and hundreds of problems wait for solution ; but the rapid progress of late years makes us confident that greater effects still will flow, as the knowledge of the causes of disease becomes more precise, and the technical means of prevention are more perfectly applied.

APPENDIX.

MEMORANDUM.

[THE following pages were written by Dr. Parkes as a guide to the Medical Officers of the Arctic Expedition in the *Alert* and *Discovery*, who sailed from Portsmouth on the 29th of May, 1875, under Captain Nares. Dr. T. Colan having expressed a desire to carry out any experiments in the Polar regions that Professor Parkes might suggest as being likely to develop good results, the counterpart of the following pages (placed here as an Appendix), in Dr. Parkes's own handwriting, was communicated by Dr. Macdonald, Professor of Naval Hygiene, to Drs. Colan and Moss, before the ships sailed.]

APPENDIX.

HINTS AS TO EXPERIMENTS ON DIET AND BODY-TEMPERATURE IN THE POLAR REGIONS.

The chief point of interest as a matter of diet in Arctic travelling appears to me this—to determine the best kind of food for maintaining the strength and endurance of the body, and for keeping up its temperature. It seems probable, *à priori*, that the food which most sustains the body will be also that which most warms.

Unfortunately, it will be, I fear, very difficult to carry out any lengthened experiments, for two reasons:—first, in Arctic travelling it would not be right either to the man or to the expedition to run any risk of lessening his strength, and yet in experiments with different kinds and amounts of food there is always the chance, and indeed the certainty, that in trying to get a safe experimental result a man may receive less food than is good for him ; secondly, it will probably be very difficult, when the ship is left, to make accurate observations on the temperature of the body. It will

be impossible I fear to take axilla temperatures, and still more rectal; and the mouth will have to be used. But in addition to the great chance of some of the cold air finding its way into the mouth, either directly or through the nose, I presume it is possible that the temperature of the whole cheek may be sometimes reduced. I think, therefore, that the observations will have to be taken under the tongue, and this is rather an irksome thing, particularly if (as must be the case) the thermometer has to be retained *in situ* for fifteen or twenty minutes to give a proper result.

These difficulties which I anticipate may, however, appear less formidable to the medical officers of the expedition, and I may be exaggerating them. I will only say that if it be possible to make observations on diet and alcohol they will be of the highest interest.

1. With regard to sustaining power during sledge travelling, &c., the comparative effect of the same food given hot and cold to different men would be of interest. Would the mere heat alone of hot food have a renovating or sustaining power? Also would the temperature of the body be affected? This is an experiment which could do no harm, as the amount of food in each case would be the same.

2. While I think it would be hazardous in any

case to lessen the amount of nitrogenous food, I think some careful experiments on the comparative effects during labour of fat and starch (or sugar, or both starch and sugar) would be highly interesting. To make the experiments comparable, the amount of the starch should be two and a half times that of the fat, and the starch must be made with hot water, though it may be allowed to cool, so as to be of an equal temperature with the fat when taken. If two men were chosen, and on one day one man received (in addition to his meat and bread, or biscuit, coffee, &c.) fat, and another starch, and then on the following day these articles were reversed, and in this way several experiments were made, the effect on the power of enduring fatigue and on the animal temperature might be made out.

3. As to the quantity of fat which can with advantage be taken, and as to the best kind of fat? The experiment here would be easy, as in addition to the ordinary food, it would only be necessary to give one-half, one, two, three, or more ounces of fat, so as to see how much the system could take in and use. I would recommend the use of cod liver oil for these experiments, as there seems to be no kind of fat so easy of digestion.*

* I may recal to mind the fact of the use of oil in smearing the surface of the face and neck, so as to lessen the cooling effect of cold currents of air.

4. The effect of alcohol on temperature of body and endurance of fatigue is a problem of the highest interest. The experiments on men and animals in temperate climates seem conclusive that alcohol slightly lowers body temperature. It would seem then to be unfitted for Arctic travelling, but it may possess other properties compensating for this defect, such as its effect in increasing digestive power (if this is real), and its action on the heart. At the same time, it certainly seems to me that the torpor-producing and nerve-deadening effect of alcohol in large doses taken with its action on temperature render its use very doubtful. There can be no doubt that experience alone during Arctic travelling can determine its precise utility, and there is no problem in dietetics more interesting at the present time than this. The mode of conducting the experiments would be, I should think, to record the sensations of the man, his pulse and temperature, with and without alcohol, under the same conditions of labour and food as far as possible.

5. The comparative effect of coffee, tea, and cocoa, in the same way might be tried.

I would suggest drinking the grounds of the coffee (made as fine as possible) like the Turks, and to make the tea with the water which has been boiled on the old tea.

Such appear to me (independent of the question of scurvy) the chief points which could be investigated in Arctic travelling.

On board ship, the thermometric observations would be easier, and I would advise rectum temperatures to be taken if it be possible.

Spirometric Observations.—Remembering the experiments of Rattray on spirometric observations in temperate and tropical regions, would it be possible to make some similar observations on five or six men before they leave England, and again in the middle of the Arctic winter on board, and during travelling when the men are away from the ship?

Casella's spirometer is very convenient for observations of this kind as it is so portable.

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THE END.

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